National Aeronautics and Space Administration

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Engineering Design

Hands-on Activities for the Classroom

Connecting math, science, and technology in one activity

Engineering Design Challenges

NASA's Classroom Connection

Engineering Design Challenges connect students in their classrooms with the challenges faced by NASA engineers as they design the next generation of space vehicles, habitats, and technology.

Designed specifically for middle and high school students, teams work with their teachers on design challenges that help students achieve national goals in science and mathematics, and build thinking skills.

Working under the supervision of their teachers, students design, build, test, redesign, and rebuild models that meet specified design criteria, employing the same analytical skills as engineers as they improve and refine their designs. The design challenge culminates in the classroom with each student team preparing and presenting the process they used and the results of their work.

A Winning Relationship Between Teachers, Students, and NASA

Engineering Design Challenges have been designed as an integral part of classroom work. There are two categories of design challenges those that are done in the classroom with an accompanying Educator Resource Guide and those that are more in depth NASA projects. All design challenges have been field tested to ensure that they are educationally appropriate and valuable. Teachers who wish to participate in the classroom based program with their students should download the Educator Resource Guide for the challenges they wish to conduct and use them as guides for carrying out the challenges with their students. Each guide contains step by step instructions for making each challenge an exciting adventure of discovery for both teachers and students. The Educator Guides also include reproducible handouts for parents to inform them of their child s work along with suggested activities to conduct at home.

How to Participate

Participating in a design challenge is easy. Simply download the Educator Resource Guide and follow the step-by-step instructions. There is no application form required to participate and your results are tracked internally, so there is no requirement to "submit" results.

Educator Resource Guides are available on a wide range of topics. Below are just a few examples of the resources NASA has for teachers to use in the classroom.

Water Filtration
http://www.nasa.gov/education/waterfiltration

On the Moon
http://www.nasa.gov/education/moonguide

Adventures in Rocket Science
http://www.nasa.gov/education/rocketscience

Thermal Protection Systems (TPS)
http://www.nasa.gov/mission_pages/constellation/ares/thermal.html

Spacecraft Structures (SS)
http://www.nasa.gov/mission_pages/constellation/ares/structures.html

In-Depth NASA Engineering Design Challenge Projects

Student teams can also participate in more in-depth NASA design projects. Requirements vary for each project. Please go to the project Web site for details on how to participate.

High Schools United With NASA to Create Hardware

The High Schools United with NASA to Create Hardware (HUNCH) project is a collaborative effort among NASA Space Operations and Exploration Systems mission directorates and Marshall Space Flight Center's Academic Affairs, Training and Crew Operations, and Ares Projects offices. They provide "work-world" experiences for students by engaging them in the design, fabrication, and rapid prototyping of multiple products for use in the Ares I mockup. High school students will be challenged to meet NASA s work requirements as they coordinate to plan, design, and model hardware for the Ares I upper stage and J-2X engine.

Go to <**www.nasa.gov/education/HUNCH**>
for more information.

NASA Great Moonbuggy Race

The Annual NASA Great Moonbuggy Race, held each spring in Huntsville, Alabama, at the U.S. Space & Rocket Center, requires students to design a human-powered vehicle that addresses a series of engineering problems that are similar to problems faced by the original Moonbuggy team. Student teams consisting of six members are responsible for building their own buggy and choosing two team members to drive the course.

Go to <**http://moonbuggy.msfc.nasa.gov/**>
for more information.

Student Launch Initiative

The NASA Student Launch Initiative (SLI) involves middle and high school students in designing, building, and testing reusable rockets with associated scientific payloads. This unique hands-on experience allows students to demonstrate proof-of-concept for their designs and gives previously abstract concepts tangibility. Teams must qualify to be eligible to participate in SLI.

Go to <**http://education.msfc.nasa.gov/sli**>
for more information.

Team America Rocketry Challenge

The Team America Rocketry Challenge (TARC) is the world's largest rocket contest, sponsored by the Aerospace Industries Association (AIA) and the National Association of Rocketry (NAR). Approximately 7,000 students from across the nation compete in TARC annually. Teams design, build, and fly a model rocket that reaches a specific altitude and duration determined by a set of rules developed each year.

Go to <**http://www.rocketcontest.org/**>
for more information.